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Why Don't They Lend? Credit Stagnation in Latin America

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This study examines the recent marked slowdown in bank credit to the private sector in Latin America. Based on a study of eight countries—Argentina, Bolivia, Brazil, Chile, Colombia, Peru, Mexico, and Venezuela—the magnitude of the slowdown is documented, comparing it to historical behavior and to similar episodes in other regions of the world. Second, changes in bank balance sheets are examined to determine whether the credit slowdown is merely a reflection of a downturn in bank deposits or whether the asset side has changed. Third, following an econometric disequilibrium approach used in recent studies of bank credit in East Asia and Finland, the paper investigates the possible causes in three countries: Colombia, Mexico, and Peru. While both supply and demand factors appear to have played key roles, their relative importance has varied across the three countries. [JEL G21]

After experiencing moderate to high rates of growth during most of the 1990s, several Latin American countries witnessed a significant slowdown over the past two years. As Table 1 illustrates, Argentina, Bolivia, Brazil, Chile, Colombia, Peru, and Venezuela recently experienced declines in their growth rates, ranging from about 1 percentage point in Brazil to 7 percentage points in

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Table 1. Average Real Growth Rates of GDP and Credit to the Private Sector

Selected Latin American Countries

	GDP		Deposit Money Banks Credit to the Private Sector	
	1992–98	1999–2000	1992–98	1999–2000
Argentina	5.0	–2.0	10.9	–2.3
Bolivia	4.3	1.4	15.8	–2.7
Brazil	3.0	2.2	4.1	–5.0
Chile	7.7	2.1	11.4	6.5
Colombia	3.8	–0.7	13.1	–10.0
Peru	4.8	2.0	27.1	–1.7
Venezuela	2.0	–1.5	–7.7	0.6
	1992–94	1995–2000	1992–94	1995–2000
Mexico	2.5	3.5	19.6	–14.6

Source: *International Financial Statistics.*

Argentina. One prominent exception to this behavior is Mexico, for which economic growth accelerated by about 1 percentage point on average after 1995.

In many cases, the evolution of bank credit to the private sector has followed a similar, or even more pronounced, cyclical pattern. When deflated by consumer prices, during the above periods credit growth decelerated by about 5 percentage points in Chile, by over 9 percentage points in Brazil, by 13 in Argentina, 18 percentage points in Bolivia, and by over 20 percentage points in Colombia and Peru. Mexico and Venezuela stand in contrast, however; in Mexico credit growth fell 34 percentage points, even as economic growth was accelerating;[1] and in Venezuela economic growth declined while credit enjoyed a modest recovery.

Given that in most Latin American countries only a few large corporations can tap foreign capital markets, understanding the recent slowdown in domestic bank credit becomes a very relevant issue. In policy circles it is widely believed that the credit slowdown is an important driving force behind the recent economic slump, and that monetary policy may be, at least partly, to blame. This idea is consistent with the "credit channel" literature, which, starting with the seminal work by Bernanke and Blinder (1988), Romer and Romer (1990), and others, shows how the provision of credit by banks to the private sector constitutes a key conduit through which monetary policy affects the real economy.

[1]Two explanations have been offered for this lack of a relationship between credit growth and economic activity in Mexico. First, it has been pointed out that large corporations have ample access to foreign capital markets, thereby being able to invest and grow in spite of the fact that, following the 1994 "tequila crisis," the Mexican financial system has experienced severe difficulties. A second interpretation has to do with accounting issues—while we observe a decline in credit when we look at banks' assets, corporations who have not repaid their credits or who have had access to debt restructuring programs have not seen their effective financing curtailed.

However, tightness of monetary policy is not the only possible reason why credit is stagnating in Latin America. It may be the case that, due to deteriorating economic conditions, there is little *demand* for credit from the private sector, as agents' balance sheets and investment prospects have worsened. Regarding supply, it may be that banks have suffered from sluggish growth in their loanable funds (that is, deposits), thus affecting their *ability* to lend. Finally, banks may have become less *willing* to lend, perhaps partly due to deteriorating economic conditions but also to their perception of risk and to the regulations regarding their risk taking. Policy implications as to how to address this credit stagnation will depend crucially on a correct interpretation of the underlying factors. Interventions, if warranted, might range from programs to alleviate corporate debt burdens, enhancing the provision of liquidity on the part of the central bank, or revising the regulatory framework regarding the level of provisions.

I. Credit Stagnation in Latin America: A First Look

In this section we describe the recent performance of bank credit in eight countries mentioned in the previous section. First, we show the evolution of credit in historical context, comparing the recent behavior to previous cycles over a period of about 30 years. Secondly, we compare the slowdown with several international cases where pronounced credit contractions were studied. Thirdly, we focus on the last 20 years, using a simple balance sheet decomposition to detect where the major changes occurred in the behavior of banks from one period to the next.

The Credit Slowdown in Historical and International Context

Several differences and similarities arise when comparing the evolution of bank credit over the past 30 years in Latin America. Using *International Financial Statistics* (IFS) data, in Figure 1 we plot the ratio of private sector bank credit to GDP for the 1960–2000 period. We show this ratio both from Deposit Money Banks (DMB), as well as from the entire banking system, DMB plus Other Banking Institutions (OBI).[2] While six out of eight countries—Brazil and Chile being the exception—exhibit a slowdown with some amount of decline in the ratio in recent years,[3] the patterns for the entire period are not all alike. In Peru and Bolivia the slowdown seems to be an interruption in a process of rapid credit growth after hyperinflation had driven credit close to zero. Brazil, Chile, Mexico, and, especially, Argentina all experienced pronounced credit cycles since the 1960s. For Colombia there has been a modest but steady upward trend since 1960 and for Venezuela a sustained downward trend since the early 1980s.

[2] Although definitions vary across countries, DMB is meant to comprise institutions that raise a significant portion of their funds from the public in the form of demand deposits. OBIs, on the other hand, are banking institutions that raise little or no funds from demand deposits.

[3] Following Gourinchas, Valdés, and Landerretche (2001), we divide the end-year stock of credit in year t by the geometric average of GDP in t and $t+1$. Thus, we include forecasts of GDP for 2001, based on real GDP forecasts by the IMF and ECLA, and on the latest inflation figures available.

Figure 1. Latin America: Credit-GDP Ratios 1960-2000

Given this recent decline in bank credit to the private sector, it is relevant to examine whether there has been a substitution towards financing by nonbank financial institutions. For most of the countries this is clearly not the case, since the definition of OBIs is sufficiently broad to include such institutions as savings and loan corporations, credit cooperatives, investment banks, and financial funds. In two of the countries, however, IFS provides an additional category, "Nonbank Financial Institutions" (NFI)—leasing companies, brokerage houses and distributor companies in Brazil, and pension funds in Chile. Substitution toward NFIs does not appear to have taken place in Brazil, as nonbank credit amounted to less than 4 percent of bank credit in 2000. In Chile, on the other hand, the credit slowdown corresponded to a sharp rise of pension funds in the late 1980s, reaching almost one-quarter of bank credit by 1991. In the case of Mexico, information for savings and loan institutions (SLIs), investment societies, and brokerage houses shows that SLIs constituted a very small share of bank credit—less than 1 percent—while security holdings by the other nonbank institutions have been expanding rapidly since 1996, suggesting that corporate financing through the stock market has substituted to some degree for the slowdown in bank credit.[4]

How does the recent experience compare with historical behavior of bank credit? We undertook a second exercise using the 1960–2000 data, based on the Gourinchas, Valdés, and Landerretche (2001) study of credit booms. We used the Hodrick-Prescott (H-P) filter to calculate the trend in the credit-GDP ratio and then identified periods of credit booms as those in which the observed ratio is significantly above trend.[5] As Table 2 and Figure 2 show, several countries experienced credit booms prior to their recent slowdowns; for instance Bolivia, Brazil, and Mexico all had credit booms in the early 1990s. Although the well-known end-of-period problem associated with the H-P filter does not allow us to derive similar conclusions regarding the severity of the recent slowdowns, we do observe from mid-period observations that, prior to the more recent recoveries, both Chile and Venezuela experienced severe credit contractions during the early 1990s, when credit-GDP fell well below trend.

How does the recent Latin American experience compare with those of credit slowdowns in other regions of the world? We examined the following international cases of pronounced credit contractions: Finland in 1992–97 (Pazarbasioglu, 1997), Indonesia in 1997–99, and Thailand in 1998–2000 (both in Ghosh and Ghosh, 1999); Japan in 1993–99 (Woo, 1999); Korea in 1997–98 (in Ghosh and Ghosh, 1999, and Kim, 1999); and the United States in 1990–93 (Bernanke and Lown, 1991; and Peek and Rosengren, 1995). In Table 3 we compare the episodes by showing the declines in credit-GDP with respect to a peak level for each of the slowdown episodes. For the non-Latin American countries, experiences vary widely. Finland, Indonesia, and Thailand register dramatic declines in a relatively short period of time, Korea experienced a short-lived and small drop, whereas

[4]For a complete set of IFS definitions of bank and nonbank credit, and for figures on nonbank credit, see Appendix Tables A.1 and A.2 in Barajas and Steiner (2002).

[5]As Table 2 shows, we chose an absolute threshold of 5 percentage points and a relative threshold of 25 percent, consistent with Gourinchas, Valdés, and Landerretche (2001). Thus, an observation in which actual credit-GDP surpassed the trend by either of these thresholds was defined as a credit boom.

Table 2. Latin American Credit Slowdowns in Historical Context

	Argentina	Bolivia	Brazil	Chile	Colombia	Mexico	Peru	Venezuela
Deposit Money Banks								
Average Credit/GDP 1960-2000	14.5	16.0	13.6	29.6	13.1	10.2	10.5	17.8
Most recent credit boom[1]								
Relative	1979–82	1981–82	1994	1981–84	—	1992–95	1981–86	—
Absolute	1961	1992–95	1994–95	1981–85	—	1992–95	—	—
Deviation from trend[2]—recent years								
1997	0.40	–0.44	–0.90	2.61	1.89	–1.54	2.95	2.00
1998	1.94	3.68	0.16	2.72	3.65	–0.94	3.75	1.97
1999	0.47	0.29	–2.29	2.00	–0.40	–2.60	1.49	1.26
2000	–1.52	–6.75	–0.36	1.01	–2.62	–3.59	–2.74	1.92
Recent annual real growth rates of credit								
2000	–3.1	–6.6	11.9	6.6	–4.1	–13.9	–4.9	10.6
2001[3]	–11.2	–9.2	–2.0	9.4	3.3	–12.2	–0.4	8.1
All Banks: Deposit Money Banks & Other Banking Institutions								
Average Credit/GDP 1960–2000[4]	15.8	20.3	30.0	53.8	26.2	20.7	14.3	31.5
Most recent credit boom[1]								
Relative	1979–82	1982	...	...	...	1992–95	1981–86	—
Absolute	1961	1998	...	...	...	1992–95	—	1982–83
Deviation from trend[2]—recent years								
1997	0.35	1.48	...	...	...	–1.61	3.00	2.23
1998	2.02	5.57	...	...	...	–1.40	3.92	2.80
1999	0.64	0.57	...	...	...	–3.10	1.67	2.99
2000	–1.46	–6.90	...	...	...	–3.96	–2.50	4.08
Recent annual real growth rates of credit								
2000	–3.1	–5.0	10.1	6.0	–15.2	–12.2	–4.9	5.3
2001[3]	–11.2	–6.3	–3.3	8.7	–8.6	–10.9	–0.4	–2.5

Sources: *International Financial Statistics;* and authors' calculations.

[1]Defined as a period containing at least one year in which the credit-GDP ratio is at least 5 percentage points (absolute) or 25 percent (relative) above its trend value.

[2]Trend calculated using a Hodrick-Prescott filter on the original series, with smoothing factor = 100.

[3]Twelve-month growth rate based on the latest monthly observation available: August 2001 (Brazil, Venezuela, Mexico, and Peru) and September 2001 (Chile, Argentina, Bolivia, Colombia).

[4]Average taken over the longest period within 1960–2000 for which data are available.

Figure 2. Latin America: Absolute Deviations in the Credit-GDP Ratio with Respect to Trend

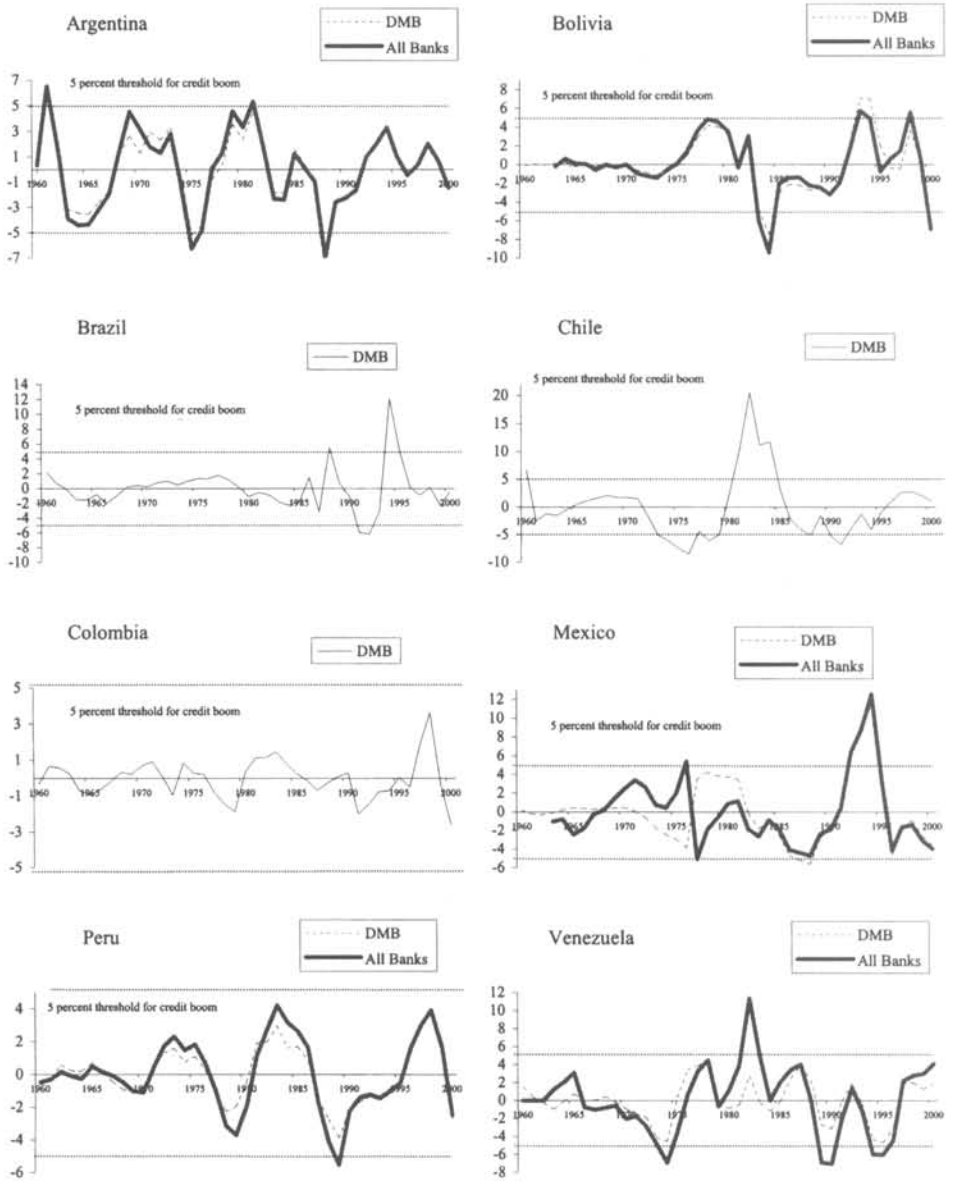

Table 3. Latin American Credit Slowdowns in Comparison to Selected International Cases

Credit to the Private Sector by the Banking System (except where otherwise indicated)

	Slowdown Period	Credit/GDP At End of Slowdown	Difference vs. Most Recent Peak	Average Yearly Fall From Peak
Latin American countries				
Argentina	1999–2000	24.1	–0.7	–0.3
Bolivia	1999–2000	57.6	–5.2	–2.6
Brazil	1995–99	32.4	–6.4	–1.3
Deposit Money Banks		26.7	–6.7	–1.3
Colombia	1999–2000	25.7	–9.5	–4.8
Deposit Money Banks		17.9	–4.7	–2.3
Chile	1985–91	40.0	–29.6	–4.2
Deposit Money Banks		38.0	–18.0	–2.6
Mexico	1995–2000	13.1	–5.5	–1.8
Deposit Money Banks		11.4	–19.3	–3.2
Peru	1999–2000	25.8	–1.5	–0.7
Venezuela	1983–95	8.0	–56.0	–4.3
Deposit Money Banks		5.9	–23.4	–1.8
Other cases of credit slowdown				
Finland	1992–97	51.2	–44.3	–7.4
Indonesia	1997–99	49.3	–32.2	–10.7
Japan (Deposit Money Banks)	1993–99	114.8	–4.1	–0.6
Korea (Deposit Money Banks)	1997–98	43.2	–1.4	–1.4
Thailand	1998–2000	101.1	–35.6	–11.9
United States	1990–93	100.1	–13.0	–3.2

Sources: *International Financial Statistics;* Bank of Korea; and authors' calculations.

Japan and the United States exhibit much more modest but extended downturns in credit. Of all the countries in the table, the largest total decline in credit-GDP was 56 percentage points, experienced by Venezuela (1983–95), followed closely by Finland's 44 percentage point contraction (1992–97). On a per year basis, the largest declines were those of post-crisis Thailand and Indonesia, where over 10 percentage points were lost per year. Credit-GDP fell by almost 30 percentage points in the case of all banks in Chile (1985–91) and by about 19 percentage points for DMBs in Mexico, or over 3 percentage points per year, and over 4 percentage points per year for all banks in Colombia.

On the surface it may appear that the recent credit slowdowns in Latin America have been less pronounced than in other parts of the world. However, the experience of earlier episodes—including Chile, Finland, and Venezuela—show that they did become severe over time. So far the recent Latin American slowdowns have been relatively short, lasting about 3 years as opposed to 13 years in Venezuela, 7 in Chile, and 6 in Finland. In Latin America we might be witnessing the first stages of a more protracted process. Table 3 also shows that the credit contractions continued well into 2001 in all countries, and even intensified in several cases.

Table 4. The Recent Credit Slowdown in Latin America—A Summary

	Argentina	Bolivia	Brazil	Colombia	Mexico	Peru
Deposit Money Banks						
1. Preliberalization period			1980–90			
Average real growth rates						
Credit to the private sector	–6.7	6.5	6.5	5.4	0.8	–14.8
Deposits	–12.0	5.1	7.5	3.3	–1.8	–14.7
End-of-Period ratios						
Loans/Deposits	189.3	123.1	141.0	120.0	84.7	50.9
Loans/Assets	53.0	79.1	48.4	65.4	65.6	27.7
Credit/GDP	9.6	19.3	13.6	13.3	15.4	5.3
2. Postliberalization period						
a. Credit expansion period	1991–98		1991–94	1991–98	1991–94	1991–98
Average real growth rates						
Credit to the private sector	12.3	18.1	20.5	9.9	29.2	34.6
Deposits	22.0	16.7	25.8	10.6	13.7	22.9
End-of-Period ratios						
Loans/Deposits	97.8	134.8	118.6	113.5	141.1	105.5
Loans/Assets	61.9	82.9	63.3	71.8	87.2	69.8
Credit/GDP	24.2	54.6	33.4	16.9	34.1	27.3
b. Credit slowdown period	1999–2000		1995–99	1999–2000	1995–2000	1999–2000
Average real growth rates						
Credit to the private sector	–2.2	–2.9	1.7	–9.1	–14.3	–0.9
Deposits	5.2	–0.8	–2.4	3.0	–2.7	6.2
End-of-Period ratios						
Loans/Deposits	84.5	128.3	120.2	88.5	66.1	99.6
Loans/Assets	57.1	79.9	58.3	61.2	32.2	68.1
Credit/GDP	23.4	49.9	26.7	18.1	13.1	25.8

Sources: *International Financial Statistics;* and authors' calculations.

The Latin American Credit Slowdown: Some Stylized Facts

We now turn to a closer look at the evolution of credit and bank behavior in our eight countries, focusing on a shorter sample period, 1980–2000. In Tables 4 and 5 we show average annual real growth rates of credit and deposits for different subperiods, as well as the ratios of credit to deposits and credit to total assets. For the six countries in which the slowdown is recent (Argentina, Bolivia, Brazil, Colombia, Mexico, and Peru; see Table 4), we divide the period into three portions: (1) the preliberalization period of the 1980s, characterized by relatively repressed financial markets and thereby low credit growth; (2) the expansion period of the early 1990s, spurred in part by financial liberalizations undertaken at the beginning of the decade; and (3) the recent slowdown period. The expansion is defined as ending in the year when credit-GDP reached its peak of the 1990s. In Brazil and Mexico, credit peaked in 1995; in Argentina, Bolivia, Colombia, and Peru, in 1998.

For the other two countries, Chile and Venezuela (Table 5), the slowdown occurred earlier, and the more recent period is characterized by a recovery in credit.

Table 5. Earlier Credit Slowdowns in Latin America—A Summary

	Chile	Venezuela
Deposit Money Banks		
1. Credit expansion period	1974–84	1975–82
Average real growth rates		
Credit to the private sector	39.4	8.6
Deposits	15.1	7.6
End-of-Period ratios		
Loans/Deposits	256.1	93.8
Loans/Assets	82.0	79.6
Credit/GDP	56.1	29.3
2. Credit slowdown period	1985–91	1983–95
Average real growth rates		
Credit to the private sector	1.4	–8.8
Deposits	11.8	–2.5
End-of-Period ratios		
Loans/Deposits	128.8	39.7
Loans/Assets	86.4	37.7
Credit/GDP	38.0	5.9
3. Credit recovery period	1992–2000	1996–2000
Average real growth rates		
Credit to the private sector	11.0	6.3
Deposits	9.7	–4.8
End-of-Period ratios		
Loans/Deposits	142.6	69.2
Loans/Assets	86.2	51.9
Credit/GDP	64.0	9.5

Sources: *International Financial Statistics;* and authors' calculations.

In Chile, financial markets were liberalized much sooner than in the rest of the region, while Venezuela observed a positive terms of trade shock after 1973, and faced severe macroeconomic distress in the early 1990s. Thus, we divide the sample period for these two countries into the following subperiods: (1) credit expansion in the 1970s and early 1980s; (2) credit slowdown in the late 1980s and early 1990s; and (3) credit recovery in the late 1990s.

There are several consistent patterns across the first group of countries. The acceleration and subsequent slowdown observed in credit growth also occurred on the deposit side. The latter may have been the result of deregulation and financial reform programs that reduced taxes on financial intermediation, liberalized interest rates, and encouraged savings through the banking system. In the more recent period there has been a disintermediation process following a period of financial turmoil, in which capital outflows took place and bank deposits fell. Thus, it may be that the slowdown in credit was driven primarily by a slowdown in deposits, and banks merely reacted passively in response to a squeeze on their loanable funds. However, it appears that although deposit growth was in fact a key

factor, it was not the entire story. Indeed, except in the case of Brazil, the slowdown in credit is more pronounced than that in deposits. In fact, in some cases deposits continued to grow in real terms while real credit fell.

This behavior was not always symmetrical across the expansion and slowdown. In Argentina and Colombia, the expansion phase was more pronounced for deposits, while the slowdown was more pronounced for credit. For the other three countries, the entire cycle of the 1990s was more pronounced for credit; thus the loan-deposit and loan-asset ratios increased during the expansion and fell during the slowdown. This is also the case in the earlier slowdowns, Chile and Venezuela. In fact, in Venezuela the recent credit recovery period is characterized by a *slowdown* in deposits.

A Decomposition of Credit Growth

In this section we present a summarized balance sheet for commercial banks, and observe the major changes that took place in bank activities in the subperiods described above. We decompose credit growth to the private sector into banks' sources of funds or alternative uses of funds. Based on IFS data, we define the major balance sheet categories as:

Sources of funds (SF)	**IFS line items**
Deposits and other liabilities with the private sector:	Demand, savings, and time deposits; money market funds, bonds, and restricted deposits.
Net foreign liabilities:	Foreign assets minus foreign liabilities and long-term foreign liabilities.
Capital and other:	Capital and other items, net.
Alternative uses of funds (AUF)	
Net credit to the public sector:	Claims on central and local government, public entities, public financial institutions, minus government deposits.
Net credit to the central bank:	Reserves minus liabilities with the monetary authorities.

The distinction between "sources" and "uses" is not clear cut. For example, accumulating foreign assets may be viewed as an alternative use, while contracting a foreign debt could be considered a source of funds. The purpose was to keep a simple classification that would yield a small number of groups that could be easily identified. We proceeded to decompose credit growth to the private sector in the three periods by using the following balance sheet identity:

$$CREDIT_t = SF_t - AUF_t \Rightarrow \frac{\Delta CREDIT}{CREDIT_t} = \frac{\Delta SF}{CREDIT_t} - \frac{\Delta AUF}{CREDIT_t}.$$

This decomposition yields an average real growth rate for credit in each subperiod, which is then decomposed into each source and alternative use of funds. We then calculate the differences in growth rates between subperiods and also decompose these into sources and alternative uses. We present a summary of this calculation in Tables 6 and 7, where we indicate the four balance sheet factors that had the greatest impact on changes in credit growth in each phase and for each country.[6] Also, we define "contributing" factors as those that moved in a direction consistent with the change in credit growth rate, and "offsetting" factors as those that moved in the opposite direction. For example, in Argentina real credit accelerated from an average growth rate of –6.7 percent in the preliberalization period to 7.7 percent in the expansion period, thus a turnaround of 14.4 percentage points. Table 6 shows that two major factors contributed to this, namely deposits and capital, whose growth rate accelerated by 20.7 and 2.8 percentage points, respectively. Their effect was offset to a certain extent, however, by a deceleration in the banks' position with respect to the central bank (4.8 percentage points) and with respect to the nonfinancial public sector (2.1 percentage points).

A number of characteristics of the credit cycle become apparent. First, the single most important factor contributing to the changes in credit growth was deposit growth. For five of the eight countries it had the largest impact during the expansion, and for another five it had the largest impact during the slowdown. There are no cases in which deposits were not the dominant factor in at least one of the two phases, and in four countries—Argentina, Bolivia, Colombia, and Peru—they were the dominant factor in both phases.

Second, the comovement of deposit and credit growth dropped during the slowdown. Taking a simple average of the relative contribution of deposits to credit growth changes across the eight countries, we find that deposits accounted for 63 percent of the acceleration in credit growth during the expansion, and for 53 percent of the deceleration during the slowdown. Excluding Venezuela, where the recent credit upswing came together with a decline in deposits, the comovement drops from 77 to 50 percent, when comparing expansion and contraction phases.

Third, the net position with the central bank generally played an important role, albeit for different reasons. In three countries net central bank credit has been highly procyclical. In the case of Brazil, it was the dominant accelerating factor during the expansion and the dominant decelerating factor during the contraction. In Chile, it was the dominant accelerating element during the expansion and a major decelerating factor during the contraction. In Mexico, net central bank credit was the dominant factor decelerating credit in the recent slowdown. On the other hand, in Argentina and Peru, and to a lesser extent in Bolivia and Colombia, it played an offsetting role, contracting during the expansionary period and expanding during the contraction. In the case of Peru it was the major offsetting factor in both phases, as reserve requirements were kept high during the expansion and relaxed during the decline.

[6]In the case of Mexico, we analyzed the slowdown up to December 1996, because of an accounting change in early 1997. Most of the decline is captured in 1995–96, however, after which credit remained relatively stable for several years. In the case of Argentina, we analyzed the expansion after 1994, in order to isolate an accounting change at the end of 1993. For the complete decomposition of real credit growth in the eight countries, see Tables 4, 4a, 5, and 5a in Barajas and Steiner (2002).

Table 6. The Recent Credit Slowdown in Latin America: Major Factors Affecting Changes in Credit Growth

	Argentina	Bolivia	Brazil	Colombia	Mexico	Peru
Credit expansion period vs. preliberalization						
Change in annual real credit growth	14.4	11.6	14.0	4.5	28.4	49.4
Major factors accelerating credit growth						
First major factor	Deposits	Deposits	Central Bank	Deposits	Deposits	Deposits
Contribution	20.7	8.5	11.0	5.4	14.6	58.9
Second major factor	Capital/Other	Foreign	Foreign	Central Bank	NFPS	Foreign
Contribution	2.8	4.0	2.5	0.9	8.6	10.9
Major offsetting factors						
First major factor	Central Bank	NFPS	None	NFPS	Central Bank	Central Bank
Contribution	–4.8	–1.1		–1.8	–2.6	–18.9
Second major factor	NFPS	Central Bank	None	Capital/Other	None	None
Contribution	–2.1	–0.5		–0.6		
Relative contribution of deposits (percent)	143.3	73.2	1.6	119.6	51.4	119.4
Combined effect of major factors	16.5	10.9	13.5	4.0	20.5	51.0
Percent of total change in credit growth	114.6	94.2	96.6	87.8	72.3	103.3
Credit slowdown vs. expansion period						
Change in annual real credit growth	–10.0	–21.0	–18.8	–18.9	–64.6	–35.5
Major factors slowing credit growth						
First major factor	Deposits	Deposits	Central Bank	Deposits	Central Bank	Deposits
Contribution	–6.0	–13.3	–9.6	–9.6	–21.5	–28.2
Second major factor	Capital/Other	Foreign	Deposits	Capital/Other	Deposits	Foreign
Contribution	–4.3	–8.7	–6.4	–4.9	–18.4	–11.0
Major offsetting factors						
First major factor	Foreign	NFPS	Capital	None	None	Central Bank
Contribution	1.8	1.4	2.7			7.4
Second major factor	Central Bank	Capital/Other	Foreign	None	None	None
Contribution	0.8	1.3	0.7			
Relative contribution of deposits (percent)	60.2	63.4	34.2	50.8	33.2	79.3
Combined effect of major factors	–7.7	–19.4	–12.6	–14.5	–39.8	–31.8
Percent of total change in credit growth	77.3	92.2	67.1	76.5	61.7	89.5

Sources: *International Financial Statistics;* and authors' calculations.

Table 7. Earlier Credit Slowdowns in Latin America: Major Factors Affecting Changes in Credit Growth

	Chile	Venezuela
Credit slowdown vs. expansion period		
Change in annual real credit growth	–38.1	–17.4
Major factors slowing credit growth		
First major factor	*Foreign*	*Deposits*
Contribution	–29.5	–12.2
Second major factor	*Central Bank*	*Foreign*
Contribution	–28.5	–2.7
Major offsetting factors		
First major factor	*Capital*	*Capital*
Contribution	26.0	1.5
Second major factor	*NFPS*	*None*
Contribution	4.2	
Relative contribution of deposits (percent)	27.0	70.2
Combined effect of major factors	–27.8	–13.4
Percent of total change in credit growth	73.0	77.2
Credit recovery vs. slowdown period		
Change in annual real credit growth	9.6	15.1
Major factors accelerating credit growth		
First major factor	*Central Bank*	*NFPS*
Contribution	4.1	14.0
Second major factor	*Foreign*	*Capital*
Contribution	4.0	3.1
Major offsetting factors		
First major factor	*Capital*	*Deposits*
Contribution	–0.8	–5.3
Second major factor	*NFPS*	*None*
Contribution	–0.7	
Relative contribution of deposits (percent)	30.8	–34.9
Combined effect of major factors	6.6	11.8
Percent of total change in credit growth	69.2	78.2

Sources: *International Financial Statistics;* and authors' calculations.

Fourth, except in Colombia and Mexico, net foreign liabilities (NFL) played an important role in credit growth. They were a major contributing factor during both phases in Bolivia, Peru, and Chile and played a major role in Venezuela's contraction. On the other hand, they were a major offsetting factor in the recent contractions of Argentina and Brazil.

Fifth, a fiscal factor (NFPS in Table 6) played a major role in accelerating Mexico's credit in the early 1990s and in Venezuela's recent credit recovery. In Bolivia and Chile, and to a lesser extent in Argentina and Colombia, credit to the public sector on occasions acted as a major offsetting factor. Regarding the

slowdown, net credit to the NFPS was a significant contributing factor for all countries except Bolivia and Chile. This may reflect a fiscal expansion that squeezed out private sector credit, and/or a reduction in risk taking by banks, who may have decided to increase their holdings of relatively safe government securities rather than increase loans.

Finally, the private sector credit slowdown appears to be more complex than the expansion, as it involves changes in a larger number of balance sheet items. We generally find that the aggregate relative contribution of a small number of factors—two contributing, two offsetting—falls from the expansion to the slowdown. For example, in Argentina the major factors accounted for 115 percent of the expansion, but for only 77 percent of the slowdown.

II. Econometric Analysis

A vast empirical literature has recently emerged, which focuses on the possible causes of credit contraction in different countries.[7] In many cases the approach followed is to use data at the macro level to identify whether or not specific situations of credit contraction can be identified as being a "credit crunch," defined as a situation in which, for a given level of deposits, banks refuse to increase interest rates on their loans to market-clearing levels, and thus, excess demand for credit remains unsatisfied. Such a situation can emerge either because banks' perceptions of corporate risk are too high, or because they simply do not have enough capital to accommodate riskier loans. In our econometric estimation, we follow this type of approach (as in Pazarbasioglu, 1997; Ghosh and Ghosh, 1999; Kim, 1999; and Barajas, López, and Oliveros, 2001), which is sufficiently general to permit us to separate demand from supply-side determinants of credit growth, and allows us to capture any possible "credit crunch" phenomenon.

Methodological Issues

We estimated aggregate demand and supply functions for credit in three of the countries analyzed: Colombia, Mexico, and Peru. The econometric approach used is based on pioneering work by Laffont and García (1977) and Sealey (1979), and consists of estimating the system of supply and demand functions under the assumption that, at a given point in time, the credit market may either exhibit equilibrium, or temporary excess demand or supply owing to imperfect flexibility in the interest rate in the short run. Thus, in addition to capturing the main determinants of credit growth, the approach also allows one to assess whether a situation of excess demand, or credit crunch, occurred during an episode of declining credit growth.

[7]Empirical studies of credit contractions include Bernanke and Lown (1991) for the United States; Pazarbasioglu (1997) for Finland; Ghosh and Ghosh (1999) for Indonesia, Korea, and Thailand; Agenor, Aizenman, and Hoffmaister (2000) for Thailand; Kim (1999) for Korea; Ding, Domac, and Ferri (2000) for East Asia; Catão (1997) and Braun and Levy-Yeyati (2001) for Argentina; Berróspide and Dorich (2001) for Peru; Carrasquilla, Galindo, and Vásquez (2000); and Barajas, López, and Oliveros (2001) for Colombia. Braun and Hausmann (2001) compare credit crunches throughout the world with those in Latin America.

Actual credit observed at time t, C_t, is defined as lying either on the supply curve (excess demand), on the demand curve (excess supply), or on both (equilibrium):

$$C_t = \min(C_t^s, C_t^d), \tag{1}$$

where C_t^s and C_t^d are the supply and demand functions, respectively, defined as a function of the vectors of explanatory variables X_{1t} and X_{2t}, and error terms:

$$\begin{aligned} C_t^s &= X_{1t}\beta^s + u_{1t} \\ C_t^d &= X_{2t}\beta^d + u_{2t}. \end{aligned} \tag{2}$$

Without adequate information on the price adjustment process, and assuming that the errors u_1 and u_2 are normally distributed, a likelihood function may be determined for the above model. Defining λ_t as the probability that a given observation t lies on the supply function (that is, demand is greater than supply), and given that $g(\cdot)$ is the joint density function for supply and demand derived from the joint density function for u_1 and u_2, then the density function for C_t under the assumption of excess demand is:

$$h\left(C_t \middle| C_t = C_t^s\right) = \int_{C_t}^{\infty} g\left(C_t^d, C_t\right) \partial C_t^d / \lambda_t. \tag{3}$$

Similarly, the density function under the assumption of excess supply is:

$$h\left(C_t \middle| C_t = C_t^d\right) = \int_{C_t}^{\infty} g\left(C_t, C_t^s\right) \partial C_t^s / \left(1 - \lambda_t\right). \tag{4}$$

The unconditional density function is then equal to:

$$\begin{aligned} h\left(C_t\right) &= \lambda_t h\left(C_t \middle| C_t = C_t^s\right) + \left(1 - \lambda_t\right) h\left(C_t \middle| C_t = C_t^d\right) \\ &= \int_{C_t}^{\infty} g\left(C_t^d, C_t\right) \partial C_t^d + \int_{C_t}^{\infty} g\left(C_t, C_t^s\right) \partial C_t^s. \end{aligned} \tag{5}$$

The likelihood function is $L = \prod_t h(C_t)$, and the corresponding log likelihood to be maximized subject to the parameter values is:

$$\sum_{t=0}^{T} \log h\left(C_t\right). \tag{6}$$

Maximization of equation (6) permits the estimation of both equations as well as the estimation of the probability of observed credit lying on either of the curves, λ.[8] As in previous studies, we used OLS estimates of the supply and demand functions to provide initial values for the coefficients and standard errors. Although Maddala (1983) warns that the likelihood function is unbounded for certain parameter values, we found the OLS estimates to perform well as starting values, and convergence tended to occur relatively quickly.

Specification Issues

In specifying the supply and demand functions, several issues emerge. First, identification of the model requires that one or more variables included in one function be

[8]Details of this method are discussed in Maddala (1983) and in Gourieroux (2000).

excluded from the other. Past studies using this approach have used one key variable, lending capacity (*LC*), to distinguish the supply from the demand function. Lending capacity, defined as the availability of loanable funds, would affect banks' ability to lend but would have no impact on credit demand. We followed this approach, including as *LC* a subset of loanable funds over which banks have little discretionary power, thereby constituting an exogenous determinant of credit supply.

A second specification issue involves variables reflecting the macroeconomic and business environment, since one expects credit demand to be positively related to them, and credit supply to respond to these variables to the extent that they affect the riskiness of loans. As in previous studies, we included manufacturing production indices (*MANUF*), GDP measures (*y*), the output gap (*GAP*),[9] the expected inflation rate (*INFE*)[10] as a measure of macroeconomic stability, and the stock market index (*STKMKT*). As discussed in Ghosh and Ghosh (1999), the last variable may also reflect the availability of alternatives to bank credit—equity finance in particular—from the demand side. Thus, the stock market index will have a positive coefficient if the macro conditions effect dominates, or a negative one if the substitution effect dominates.

Third, as in previous studies, we included interest rates on deposits (*id*) and on government securities (*ig*) as proxies for the opportunity cost of bank credit either from the demand or supply side. Fourth, in contrast to previous studies, for Peru and Mexico we included the country-specific JP Morgan EMBI price,[11] which we expected to have dual effects similar to those of the stock market index. A positive impact on credit demand would arise if the dominant effect was an improvement in macroeconomic perspectives, while a negative effect would arise when EMBI signaled an increase in foreign investors' willingness to lend to domestic residents, thus drawing customers away from bank credit.

Finally, also in contrast to previous studies, we included two additional variables specific to the supply function: the ratio of nonperforming loans to total loans (*NPL*), and the ratio of loan-loss provisions to nonperforming loans (*PROV*).[12] The former reflects past credit risk and may signal financial difficulties in the banking system, while the latter reflects the severity of regulations on risk-taking in lending activities. We expected banks to diminish credit supply in response to mounting credit risk and/or increasing provisions being imposed upon them.[13] These variables also provided us with additional identifying distinctions between the supply and demand functions.

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[9]This variable was used only in the Colombian case and was obtained as a linear monthly interpolation of the quarterly output gap series constructed by Misas and Enciso (2001).

[10]We defined $INFE_t$ as a three-month moving average of the twelve-month inflation rate, centered at month *t*.

[11]For Colombia, the EMBI price was introduced too recently to be used in the estimations.

[12]Also, in the case of Colombia and Peru, we included the lagged regulatory capital ratio (capital to risk-weighted assets), but this variable generally did not perform well in the initial OLS estimations and thus tended to lead to convergence problems in the ML estimation.

[13]We use provisions as a *leading* indicator of loans because in our setup provisions are a proxy for the severity of regulations. Other things being equal, stiffer regulations today suggest lower credit supply tomorrow. This does not contradict the fact that each specific provisioning act is, in practice, *preceded* by a credit decision (Blaschke, and others, 2001). In the latter case, the lag between provisioning and credit is almost impossible to disentangle from aggregate data.

III. Estimation Results

In the next sections we describe the estimation results for each of the three countries, as shown in Tables 8–10. In all cases, the dependent variable was the natural log of real credit to the private sector, *LRCRED*, with subtle differences from country to country, as we explain below. We report the estimated parameters with their *t*-statistics, the value of the log-likelihood function, and the R^2 for the initial OLS estimations of the supply and demand functions. Since the dependent variable was found to exhibit a unit root in all three cases, we conducted tests to determine whether real credit and its predicted value formed a cointegrating vector.[14] In virtually all cases we rejected the null hypothesis of no cointegration, at least at the 5 percent level.[15] Thus, even though real credit has a unit root, it is appropriate to estimate the model in levels.

Colombia

We used both monthly and quarterly data. Monthly data were available from September 1992 to March 2001, while quarterly information was available from the last quarter of 1991 to the second quarter of 2001. Quarterly estimations allowed us to use the quarterly GDP directly. We do not report OLS estimations, which in most instances provided coefficients that were statistically significant, and with the expected sign. In order to partially deal with endogeneity problems, we use lagged values of provisions, nonperforming loans, manufacturing output, stock market indices, and real lending capacity. Most of the variables are also taken in natural logs, so that coefficients can be interpreted as elasticities.

In Table 8 we report the results of the disequilibrium ML estimation. In the first three columns we present the results for DMBs, and in the last four columns we present those for the entire financial system, adjusted by loan write offs to offset accounting changes that may not reflect the true flow of bank credit to the private sector.[16] All estimations yield some common results. Various measures of macroeconomic conditions appear to be significant in the supply and demand functions. In particular, lagged manufacturing output is positively related to both supply and demand in all monthly estimations, and real GDP is positively related to loan demand in the quarterly estimations. The stock market index appears to reflect present and future economic conditions, rather than equity finance as a substitute for bank credit; thus, its coefficient in the demand function is positive and significant across monthly and quarterly estimations. The output gap exhibits a negative coefficient, similar to the result obtained by Ghosh and Ghosh (1999)

[14] We also tested whether real credit was cointegrated with the demand-side determinants, on the one hand, and the supply side determinants, on the other. The results also supported the existence of a cointegrating vector.

[15] The full set of ADF tests, which overwhelmingly fail to reject the null hypothesis of a unit root for all definitions of real credit used in the estimations, as well as the cointegration tests, are available upon request.

[16] We obtained the unadjusted series for DMBs from IFS data, and the adjusted series for the financial system from the Colombian Banking Superintendency. As shown in Barajas, López, and Oliveros (2001), during 1998–2000, this adjustment reduces the measured annual credit decline from almost 13 percent to about 7 percent for the total financial system.

for Indonesia, and may reflect the fact that firms increase (decrease) their demand for external financing over own resources in bad (good) times. Since this variable was only available for a shorter time period, we excluded it from all but regression (1). The deposit interest rate performed better than the government interest rate as a proxy for the opportunity cost of bank credit from the demand side. As the deposit rate increased relative to the lending rate, it tended to have a positive impact on credit demand. Finally, as in previous studies, we found lending capacity to be positively and significantly related to credit supply, with an elasticity approaching unity in quarterly regressions. We used a summary measure of real lending capacity (*RLC*), defined as deposits minus reserves,[17] as well as including deposits and reserves separately. The results overall were similar, but we observed better performance, primarily in the demand function when we used the summary measure.

Some differences also arise across equations. Expected inflation tended to be slightly negatively related to credit demand, but only exhibited a large *t*-statistic in regression (4), a monthly estimation for adjusted financial system credit. Monthly estimations were noticeably better at capturing the sensitivity of demand and supply to real or nominal lending interest rates. In particular, lending interest rates were rarely significant in the supply function when using quarterly data, and the results for other variables tended to improve when this variable was excluded from the supply equation. Finally, although the measures of credit risk and regulation always exhibited the expected negative sign in the supply function, both were rarely significant at the same time. The interaction variable (*NPL*PROV*, or the ratio of loan-loss provisions to total loans) was negative and significant throughout, however, thus showing that a combination of credit risk and regulatory power had a negative impact on the willingness of banks to provide credit.

Mexico

There are important differences in the Mexican case with respect to the Colombian estimations. On the one hand, we included JP Morgan's EMBI price as an explanatory variable in the demand function. This allows us to test whether, particularly after the 1994 "tequila crisis," greater availability of foreign financing permitted the private sector to grow in spite of severe problems in the financial sector. If this was the case, then we would expect a negative coefficient in the demand function; as the index increases, foreign financing becomes more easily available and, other things constant, demand for credit from domestic banks should decline. A second difference is that we were unable to assemble the dataset for the period prior to 1993 while for the post-1993 period, there are variables for which more than one source is available.

In Table 9 we report six different estimations, for two different time periods, and using two different dependent variables. For regressions (1)–(3), the dependent variable is the stock of private credit from deposit money banks as reported

[17]In the case of DMBs, we also included foreign liabilities.

Table 8. Colombia: Credit Demand and Supply
(Maximum likelihood disequilibrium estimation)

		Dependent Variable						
		Deposit Money Banks Real credit to the private sector: *LRCRED*				Financial System Adjusted real credit to the private sector: *LRCREDA*[1]		
Demand		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant		7.304	8.922	8.914	9.545	–12.023	–24.901	–21.683
		(16.54)**	(68.14)**	(102.11)**	(32.84)**	(3.38)**	(11.13)**	(5.74)**
Lending rate	*ril*	–0.002	–0.007	–0.007	–0.001			
		(0.68)	(2.09)**	(2.67)**	(0.41)			
	il						–0.441	
							(1.51)	
Deposit interest rate	*rid*		0.021	0.022				
			(5.33)**	(5.84)**				
	id						0.199	
							(1.05)	
Interest rate on government bonds	*rig*	–0.001			0.003			
		(0.17)			(0.72)			
Interest rate differential	*il – id*					–0.459		–0.084
						(1.63)		(0.34)
Manufacturing output	*LMANUF*(–1)	0.486			0.118			
		(4.81)**			(1.79)*			
Real GDP	*y*					2.099	3.687	3.205
						(4.28)**	(14.15)**	(7.69)**
Expected inflation	*INFE*	–0.001	0.000		–0.007			
		(0.30)	(0.06)		(3.33)**			
Stock Market Index	*LSTKMKT*(–1)	0.224	0.152	0.154	0.054	0.406		0.126
		(0.53)	(5.41)**	(8.06)**	(2.24)**	(4.56)**		(1.56)
Output Gap	*GAP*	–4.045						
		(9.29)**						
Sigma		0.019	0.020	0.020	0.007	0.016	0.046	0.051
		(4.17)**	(6.69)**	(6.61)**	(2.59)**	(1.12)	(6.28)**	(2.54)**
R^2 (OLS)		0.853	0.876	0.683	0.824	0.945	0.941	0.940
Supply								
Constant		2.759	0.723	2.574	1.173	1.187	7.131	1.781
		(5.68)**	(2.03)**	(2.34)**	(2.47)**	(5.95)	(3.22)**	(1.81)*
Lending capacity variables								
Real lending capacity[2]	*LRLC*(–1)	0.731				0.918		
		(14.39)**				(37.73)**		
Deposits	*LRDEP*(–1)		0.701	0.704	0.830		0.416	0.856
			(7.61)**	(8.07)**	(22.62)**		(2.29)**	(9.55)**
Reserve Ratio	*RR*(–1)		–1.323	–1.270	–0.583			
			(4.19)**	(4.23)**	(3.31)**			
Reserves	*LRRES*(–1)						–1.621	–0.671
							(1.71)*	(1.98)**
Lending rate	*ril*	0.008	0.004	0.003	0.002			
		(5.02)**	(1.81)*	(1.76)*	(2.48)**			
	il					–0.012		
						(0.35)		
Manufacturing output	*LMANUF*(–1)	0.053	0.264	0.259	0.189			
		(0.67)	(3.62)**	(3.52)**	(6.75)**			
Non-performing loans	*LNPL*(–1)	–0.125	–0.091		–0.003	–0.051		–0.062
		(3.57)**	(1.30)		(0.13)	(1.79)*		(1.56)
Provisions	*LPROV*(–1)	–0.065	–0.169		–0.075			
		(1.60)	(3.50)**	**	(4.60)**			
NPL*Provisions	*LNPLPROV*(–1)			–0.129			–0.163	
				(2.72)**			(2.31)**	
Sigma		0.033	0.033	0.034	0.017	0.024	0.025	0.031
		(12.76)**	(11.25)**	(11.37)**	(10.26)**	(5.99)**	(3.59)**	(4.06)**
R^2 (OLS)		0.960	0.949	0.949	0.982	0.984	0.955	0.952
Frequency		Monthly				Quarterly		
Period		1993:12 – 2001:03	1993:01– 2001:05	1993:01– 2001:05	1993:01– 2001:02	1992:1–2001:2		
Observations		88	101	101	98	38	38	38
Log Likelihood		192.322	223.744	222.761	273.703	91.698	75.870	73.940

Notes: t-statistics shown in parentheses. Significance levels of 5 percent (**) and 10 percent (*) indicated. The letter *L* at the beginning of a variable name denotes natural logarithm.

[1]Adjusted credit is defined as the stock of credit plus loan write-offs. In addition, in regression (4) two small state-owned financial institutions are excluded.

[2]Defined as deposits plus foreign liabilities minus reserves.

by the IFS, we used monthly data for 1993:12 to 2000:12. This time period allows us to capture part of the pre-1995 lending boom as well as the subsequent downturn. Similar to the Colombian case, for regressions (4)–(6) we used an adjusted credit series constructed by the Banco de México, which incorporates the effects of two major debt restructuring programs,[18] one consisting of a partial write off of bank debts funded, and another consisting of a government purchase of nonperforming loans. The time period is 1997:02–2001:05, and thus includes only the downturn phase. In most estimations, we used real GDP in order to proxy for aggregate macroeconomic conditions. Since GDP is available quarterly, we used the same real GDP level for each month within the quarter. In the last estimation, regression (6), we used the monthly index of manufacturing production.

There are two sources of data for nonperforming loans. The first, which we used in regressions (1)–(3), was obtained from the World Bank. This series is quarterly, and was available from 1992:4 to 2000:4. Monthly series for both nonperforming loans and the loan-loss provisions were obtained from the Banco de México, but were available only starting in 1997:01, and so were used in regressions (4)–(6).

In all six estimations, the EMBI price appears to be negatively and significantly related to credit demand, reflecting the degree of substitution for Mexican firms between domestic and foreign financing. As expected, demand for loans is negatively related with the lending interest rate, and the respective coefficient is statistically significant in all but one estimation. Finally, the demand for financial sector loans is positively associated with economic activity, either proxied by real GDP or manufacturing output. However, this association is significant only in two of the six estimations reported.

Regarding the supply of bank loans, in general it is associated in a positive and statistically significant manner with lending capacity, which we defined in two alternative ways: *DEP1*, equal to the sum of demand, time, and foreign currency deposits; and *DEP2*, which also includes money market funds.[19] As expected, the supply of loans depends positively on their interest rates, and most of the regressions yielded a statistically significant coefficient.

We attempted to capture the opportunity costs of alternative uses of bank funds, by including the interest rate on government paper (*ig*) in the supply function. We obtain a positive, albeit not statistically significant, coefficient. The best estimations were obtained when *ig* was not included.

[18]We used a measure that accounted for the effect of credit restructuring programs beginning in late 1995. The specific name given to this series is "total financing to the private sector, considering loans related to restructuring programs." This adjustment addresses to some extent the concern that the decline in private sector credit as seen from balance sheets of banks overestimates the credit contraction actually experienced by the private sector. To the extent that debts were restructured and refinanced, and in some instances directly removed from banks' balance sheets and transferred to collecting agencies, the balance sheet tends to overstate the decline in credit.

[19]Contrary to both the Colombian and Peruvian cases, throughout our study period Mexican banks were not subject to reserve requirements; therefore, we did not subtract reserves from deposits to obtain lending capacity, since held reserves would be essentially voluntary and thus endogenous to banks' lending decisions.

Table 9. Mexico: Credit Demand and Supply
(Maximum likelihood disequilibrium estimation)

		Dependent Variable					
		Deposit Money Banks Real credit to the private sector: *LRCRED*			Financial System Adjusted real credit to the private sector: *LRCREDA*[1]		
		(1)	(2)	(3)	(4)	(5)	(6)
Demand							
Constant		11.329	11.541	11.481	10.920	12.403	11.877
		(3.09)**	(3.10)**	(2.87)**	(7.07)**	(8.66)**	(18.65)**
Lending rate	*il*	–0.109	–0.106	–0.097	–0.074	–0.062	–0.121
		(–2.51)**	(–2.35)**	(1.74)*	(–2.07)**	(1.58)*	(3.49)**
EMBI price for Mexico	*EMBI*	–0.009	–0.009	–0.009	–0.006	–0.006	–0.006
		(7.90)**	(–7.82)**	(7.15)**	(7.53)**	(–8.35)**	(12.39)**
Manufacturing output	*LMANUF*(–1)						0.533
							(3.48)**
Real GDP	*Ly*(–1)	0.429	0.397	0.401	0.467	0.252	
		(0.81)	(0.74)	(0.69)	(2.01)**	(1.19)	
Sigma		0.122	0.124	0.131	0.018	0.015	0.018
		(6.17)**	(6.12)**	(5.98)**	(4.94)**	(4.56)**	(5.48)**
R^2 (OLS)		0.779	0.779	0.779	0.938	0.938	0.938
Supply							
Constant		–2.048	–0.992	–1.631	6.496	12.157	6.168
		(0.48)	(0.23)	(0.26)	(4.16)**	(2.28)**	(3.67)**
Real lending capacity	*LRDEP1*(–1)			0.984	0.571		0.586
				(2.05)**	(4.84)**		(4.82)**
	LRDEP2(–1)	0.951	0.867			0.116	
		(3.06)**	(2.84)**			(0.29)	
Lending rate	*il*	0.102	0.718	0.479	0.057	0.102	0.074
		(0.29)	(5.70)**	(5.98)**	(1.81)*	(2.74)**	(1.51)
Interest rate on government bonds	*ig*	0.635					
		(1.56)					
Non–performing loans	*LNPL*(–1)	0.153	0.134	0.106	–0.014	–0.013	–0.012
		(2.58)**	(1.78)*	(1.66)*	(7.64)**	(8.87)	(10.24)**
Dummy[2]*NPL	*D9501***LNPL*(–1)	–0.158	–0.138	–0.105			
		(–2.69)**	(1.85)*	(1.67)*			
Provisions	*LPROV*(–1)				–0.027	–0.024	–0.026
					(10.18)**	(8.87)**	(10.44)**
Sigma		0.067	0.067	0.067	0.020	0.022	0.014
		(5.94)**	(6.01)**	(5.59)**	(3.19)**	(5.63)**	(3.34)**
R^2 (OLS)		0.837	0.836	0.836	0.962	0.954	0.962
Period		1993:12 –2000:12			1997:02–2001:05		
Observations		85	85	85	52	52	52
Log Likelihood		86.308	84.795	80.781	137.46	136.05	142.13
Johansen Cointegration tests between dependent variable and predicted values from the ML estimation							
Null hypothesis: no cointegration							
λ_{trace}, 0 lagged difference terms.		15.218**	13.306**	10.561	39.598***	27.913***	50.675***
λ_{trace}, lags 1–12 included.		15.498**	16.305**	15.140**	17.957***	15.220**	32.866***

Notes: *t*-statistics shown in parentheses. Significance levels of 1 percent (***), 5 percent (**), and 10 percent (*) indicated. The letter *L* at the beginning of a variable name denotes natural logarithm.

[1]Defined as the stock of credit plus adjustments to incorporate private sector loan restructuring programs beginning in mid-1995.

[2]This dummy variable takes a value of zero up until 1994:12, and then unity thereafter, thus testing for a structural change after the credit expansion period.

Regarding loan quality, the two groups of regressions shown in Table 9 must be interpreted separately. For the longer period (regressions (1)–(3)) we use the quarterly World Bank non-performing loans data, and are unable to control for provisions. We also interacted *NPL* with a dummy variable equal to zero until the end of 1994 and equal to 1 afterwards (D9501), so as to test for the possibility that regulation and supervision became tighter—and thus bank behavior became more sensitive to credit risk—after the financial crisis of late 1994 and early 1995.

Our results are consistent with a significant shift in bank behavior after the 1994 crisis. Prior to 1995, the supply of loans to the private sector was positively associated with the level of *NPL*. One possible interpretation of this result is that, in the context of weak regulation, banks were probably "gambling for resurrection," by increasing their supply of credit when credit risk was rising.

Following the crisis, and given that we cannot reject the hypothesis that the sum of the coefficients of *NPL* and of the interactive variable (*D9501*NPL*) is equal to zero, this type of adverse behavior would have ceased. Note, however, that according to this group of regressions, we do not obtain the expected negative relationship between credit supply and *NPL*, not even in the post-crisis period.

The results reported in regressions (4)–(6) of Table 9 seem much more comforting. For the shorter, post-crisis period, and using the redefined version of credit, in all three estimations we consistently obtain negative and statistically significant coefficients both for nonperforming loans as well as for provisions. As was mentioned above, unfortunately we were unable to obtain data on provisions for the period prior to 1997.

Peru

The regression results for Peru are shown in Table 10, which we divide into two pairs of regressions according to the credit series used. In regressions (1) and (2) we use the summary variable for real lending capacity (*RLC*), and in regressions (3) and (4) we disaggregate it into its components, deposits and reserves.

Several differences emerge with respect to the other two countries analyzed. First, the Peruvian case appears to be the only one in which expected inflation is a consistently significant variable explaining demand for credit. Private agents in Peru appear to extract more information about macroeconomic conditions from the evolution of inflation. Second, in contrast to the case of Mexico, the EMBI price is now positively related to credit demand, presumably because it reflects macroeconomic conditions more than the private sector's ability to obtain financing abroad. Third, especially in regressions (1) and (2), credit demand is affected significantly by a wider set of macro indicators. Finally, it proved very difficult to arrive at supply and demand functions that both exhibited their expected signs for the lending interest rate. This may be related to the high degree of dollarization of bank activities in Peru, which makes it difficult to construct an appropriate lending

Table 10. Peru: Credit Demand and Supply
(Maximum likelihood disequilibrium estimation)

	Dependent variable: Source:	Deposit Money Banks Real credit to the private sector: LRGCRED Central Bank of Peru			
		(1)	(2)	(3)	(4)
Demand					
Constant		11.554	10.872	10.513	10.521
		(5.86)**	(35.89)**	(14.24)**	(14.15)**
Lending rate	*Lil*	–1.868			
		(4.89)**			
Deposit interest rate	*Lid*	1.667			
		(4.81)**			
	rid				
Nominal interest differential				–0.229	–0.229
				(1.25)	(1.26)
Real interest differential	*ril – rid*		–0.005		
			(1.59)		
EMBI price for Peru	*LEMBI*	0.487	0.093	0.101	0.101
		(5.27)**	(5.60)**	(1.39)	(1.39)
Stock market index	*LSTMKT*(–1)	–0.166	0.064	0.133	0.133
		(0.90)	(1.73)*	(1.80)*	(1.79)*
Expected inflation	*INFE*	–0.231	–0.680	–0.731	–0.731
		(4.69)**	(14.02)**	(15.81)**	(15.71)**
Sigma		0.011	0.004	0.009	0.009
		(1.10)	(1.66)*	(2.01)**	(2.01)**
R^2 (OLS)		0.924	0.918	0.916	0.916
Supply					
Constant		–0.163	0.219	–3.942	
		(0.27)	(0.82)	(5.25)**	
Real lending capacity					
Deposits net of reserves	*LRLC*(–1)	1.388	1.337		
		(40.05)**	(47.19)**		
Deposits	*LRDEP*(–1)			1.694	1.691
				(17.50)**	(18.14)**
Reserves	*LRRES*(–1)			–0.139	–0.134
				(1.10)	(1.10)
Lending rate	*Lil*	0.042		0.194	0.204
		(0.67)		(3.56)**	(4.44)**
	ril		0.004		
			(2.14)**		
Non-performing loans	*LNPL*(–1)	–0.471	–0.492	–0.411	
		(12.50)**	(14.27)**	(10.44)**	
Provisions	*LPROV*(–1)	–0.607	–0.560	–0.437	
		(7.07)**	(7.22)**	(5.00)**	
NPL*Provisions	*LNPLPROV*(–1)			–0.413	–0.413
				(10.52)**	(10.52)**
Sigma		0.047	0.048	0.042	0.042
		(9.89)**	(9.10)**	(9.50)**	(9.46)**
R^2 (OLS)		0.990	0.991	0.992	0.992
Period		1993:12 –2001:01			
Observations		86	86	86	86
Log Likelihood		150.164	159.456	164.491	164.430

Notes: *t*-statistics shown in parentheses. Significance levels of 5 percent (**) and 10 percent (*) indicated. The letter *L* at the beginning of a variable name denotes natural logarithm.

interest rate covering both domestic and foreign currency operations,[20] but it remains a puzzle.

We also observe some results that are common to those of Colombia and Mexico. Lending capacity—as defined in the Colombian case—was a major determinant of credit supply. As in the Colombian case, we also find better results when using the summary variable; namely, the *t*-statistics in several of the demand variables improve noticeably.[21] Credit risk and/or regulation factors also proved to be relevant for credit supply, and in regressions (1)–(3), both are significant at the same time.

Decomposition of Estimated Changes in Credit

Based on selected regression results from Tables 6–8, we decomposed the predicted changes in supply and demand, contrasting the expansion and slowdown periods in each country. We concentrated on the predicted shifts in the supply and demand curves, excluding all changes brought about as a result of adjustments in interest rates. We grouped changes in supply under three headings: macroeconomic conditions (stock market index, manufacturing output, and real GDP), lending capacity, and risk/regulation factors (*NPL*, *PROV*, or their interaction). In each case, the estimated change was defined as the coefficient multiplied by the change in the explanatory variable throughout the given expansion or slowdown period. For example, the estimated change attributable to *NPL* in Colombia during the expansion would be equal to its coefficient of –0.05 in the quarterly regression (6) multiplied by the change in *NPL* from 1992:1 to 1997:4. The results of the decomposition exercise are shown in Table 11.

Observing the components of changes in the supply curve, it is apparent that in all countries the expansion and slowdown periods were very different. With the exception of Peru, where improving loan quality contributed substantially to the expansion, in all the other countries lending capacity explained well over 90 percent of the expansion.[22] During the slowdown, however, in all countries the combination of credit and regulatory tightening contributed to a reduced willingness to lend. In fact, in Peru this effect appears to offset completely a continued expansion in lending capacity in recent years. The dominant role played by the availability of loanable funds in Colombia, particularly during the credit expansion period, is also related to the role played by capital inflows intermediated by the domestic financial system.

[20]The regressions reported use domestic currency deposit and lending interest rates. We also ran regressions using foreign currency interest rates, but there was no improvement and, in many cases, the results were worse. A possible alternative may be to construct average implicit interest rates from the balance sheet and earnings statements of banks.

[21]It must also be noted that previous regressions using the IFS series "claims on the private sector" as the dependent variable yielded extremely high *t*-statistics for *RLC*, close to 80. Since the IFS series included investments by the banking sector, the estimation equation tended to approach an identity, thus contributing to this problem. By switching to a credit series produced by the Central Bank of Peru, which excluded investments, we obtained lower *t*-statistics for lending capacity, and were able to capture more accurately the recent decline in credit to the private sector.

[22]Note that the adverse "gambling for resurrection" behavior, while statistically significant, was quantitatively small in the Mexican case.

Table 11. Decomposition of Estimated Changes in Real Credit

	Colombia		Mexico		Peru
Regression equation:	DMB (3)	Financial System (5)	DMB (3)	(6)	DMB (2)
Estimated shifts in the supply curve[1]					
Expansion period	93:12–98:12		93:12–94:12		93:12–98:12
Absolute changes due to:					
Lending capacity	0.77	0.51	0.13		1.13
Macroeconomic conditions	0.03				
Credit risk/regulatory factors	–0.09	–0.01	0.00		0.15
Slowdown period	99:01–00:12			97:02–00:12	99:01–00:12
Absolute changes due to:					
Lending capacity	0.06	–0.16		–0.10	0.13
Macroeconomic conditions	0.02				
Credit risk/regulatory factors	–0.07	–0.02		–0.12	–0.26
Estimated shifts in the demand curve[1]					
Expansion period	93:12–98:12		93:12–94:12		93:12–98:12
Absolute changes due to:					
Macroeconomic conditions	0.11	1.06	0.00		1.35
EMBI			0.20		0.07
Slowdown period	99:01–00:12			97:02–00:12	99:01–00:12
Absolute changes due to:					
Macroeconomic conditions	–0.05	–0.16		0.13	0.24
EMBI				–0.67	0.02

Sources: Tables 8–10; and data sources for estimation.

[1]The total changes are equal to the estimated change in the dependent variable, the natural logarithm of real credit to the private sector. For both supply and demand, we exclude changes attributable to the lending and alternative interest rates in order to focus on shifts in the curves.

During 1990–2000 the correlation coefficient between the capital account balance and total financial credit to the private sector was 0.698.

On the demand side, a similar asymmetry arises between the two phases. Improving macroeconomic conditions provided the key stimulus for credit growth in all countries during the expansion, and in Mexico a tightening in access to foreign financing—as reflected in a deteriorating EMBI price—reinforced this effect. Only in the case of Colombia, however, did a subsequent deterioration in macroeconomic conditions have a noticeable adverse impact on credit demand. In Mexico and Peru, macroeconomic indicators in fact continued to improve, although in the case of Mexico this effect was overwhelmed by an increase in access to foreign financing, as shown by the large negative effect of EMBI on credit demand.

Finally, comparing the size of the shifts in the supply and demand curves may permit us to assess the degree of tightness in the credit markets in these three countries. According to our econometric results, in Colombia supply of credit by commercial banks (DMB) greatly outpaced demand during the expansion, primarily due to a relative abundance of loanable funds undoubtedly brought on in part by deregulation undertaken early in the decade, which reduced certain advantages that other intermediaries had acquired over banks in previous years.

When taking the financial sector as a whole, however, the opposite appears to hold, with economic growth pushing demand faster than the rate at which supply was growing. During the slowdown, the shifts in supply and demand curves were roughly equivalent for the financial sector as a whole, thus requiring relatively small adjustments in interest rates. In Mexico, the credit market appears to have been tight at the end of the expansion, with demand having grown more rapidly than supply, but this situation was reversed during the slowdown; although credit supply did contract owing to a deceleration in lending capacity and increasing credit risk and regulatory strictness, the major impact was on the demand side. Peru exhibited pronounced accelerations of roughly the same size in demand and supply during the expansion, but appears to have entered a period of increased credit tightening; while demand has continued to grow, supply in recent years has remained stagnant as a result of decreased willingness to lend.

IV. Conclusions

In our overview of credit growth in eight Latin American countries, six are currently experiencing substantial slowdowns, which in many instances have followed episodes of "credit booms." While the early slowdowns of Venezuela and Chile seem to qualify as severe credit contractions, the current experience is still moderate by international standards. The earlier experience in the region, however, as well as that of other regions, suggests that credit slumps can be quite protracted. It is certainly possible that the current slowdown might be signaling the beginning of a long period of sluggish private sector credit. The latest figures confirm that credit continues to decline in most of the countries analyzed.

Our analysis of balance sheets over the past twenty years shows that the evolution of deposits is by far the dominant factor both in the credit expansion and slowdown stages. Interestingly, this dominant effect tends to be much stronger during the expansion period. In fact, almost the entire expansion of credit can be ascribed to an increase in loanable funds, in many instances associated with capital inflows. While the decline in loanable funds is also important in explaining credit slowdowns, other factors come into play; thus, the structure of balance sheets changed considerably in the countries examined, particularly during the most recent period.

Econometric estimations for Colombia, Mexico, and Peru, covering both the expansion and slowdown phases of the past decade, are also reported. We obtain some results that are common to studies of other countries: macroeconomic conditions significantly affect credit demand and sometimes credit supply; lending capacity plays a key role in determining credit supply; and certain alternative interest rates have a significant effect on credit demand. However, we also introduced two additional sets of variables not included in previous studies, variables which we suspected would be important determinants of credit supply or demand. On the one hand, we incorporated credit risk and regulatory variables in the supply function, and found that at least one was significant in each of the countries. Second, we incorporated the EMBI price for Mexico and Peru, finding that in the former case it reflected substitution by borrowers from domestic to foreign sources, while in the latter case it provided an additional signal on the macroeconomic environment.

Our estimation approach allowed us to decompose the shifts in supply and demand curves during the expansion and slowdown periods. Confirming the findings of our examination of bank balance sheets, we saw on the supply side that the expansions were driven primarily by lending capacity, while the risk and regulatory variables became key during the slowdown. On the demand side, the expansion was characterized by improvements in macroeconomic conditions across all countries, while in the slowdown only Colombia exhibited a clear impact of deteriorating conditions on credit demand. In Mexico, access to foreign funds appeared to be the dominant factor, and in Peru demand has appeared to continue its upward path in recent years. Finally, our results also served to highlight key differences in the nature of the credit slowdown in the three countries. In Colombia, with the most modest contraction of the three, supply and demand shifts are roughly similar. In Mexico, the situation appears to be one of excess supply, while the results for Peru point to possible excess demand for credit in recent years.

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